Characterization and Impact of Curing Duration on the Compressive Strength of Coconut Shell Coarse Aggregate in Concrete

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Partial replacement with coconut shell coarse aggregates was studied as a means to produce lightweight coconut shell concrete (CSC). Coconut shell concrete is a structural grade lightweight concrete that has a lower self-load compared to the normal weight concrete (NWC), which allowed the production of larger precast units. An experimental study and analysis were conducted using different volume percentages of 0%, 10%, 30%, 50%, and 70% of coconut shell as coarse aggregates, to produce M30 (30 MPa) grade concrete. The compressive strength of the NWC and CSC were obtained on the 7th and 28th day. The optimum results obtained for M30 grade concrete at 7th and 28th day of CSC were 34.2 and 38.6 MPa, respectively. In addition, the workability and weight-reduction were analyzed and compared with NWC. Scanning electron microscopy (SEM) with energy dispersive X-ray spectroscopy (EDS/EDX) and Fourier transform infrared spectroscopy (FTIR) were also used to investigate the structural morphology, chemical composition, and infrared functional groups of the concrete.

Keywords: Coconut; Compressive; Morphological; Chemical; Functional groups

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INTRODUCTION

A huge amount of waste coconut shells is produced in tropical countries, especially Malaysia, where the disposal of this agricultural waste contributes to high disposal in landfills. For the past few years, researchers have started to extensively study the feasibility of employing this agricultural waste as coarse aggregates in concrete, which produces a lightweight concrete, such as coconut shell concrete (CSC). The increase in the development of infrastructure, such as buildings and utilities around the world, are directly contributing to the increasing demand for construction materials. Concrete is the most widely used construction material for most major construction projects (Ahlawat and Kalurkar 2014). Concrete is the second most consumed material around the globe behind water with 7.23 billion tons of production each year (Meddah *et al*. 2010; Chandar *et al.* 2019). Typically, in concrete, around 60% to 75% of a concrete mixture has consisted of aggregates (Kanojia and Jain 2015). The need for gravels as coarse aggregates is expected to reach 2050 million metric tons by year 2020 (Kanojia and Jain 2017). Therefore, the future development involved sustainability and environmentally friendly materials. There